METHOD FOR ITERATIVE DECODER SCHEDULING

5   **Technical Field of the Invention**

The present invention relates to communication systems where decoders are used to decode an incoming stream of data blocks. More specifically, the method according to the invention relates to a way of scheduling

10   the data blocks to a number of iterative channel decoders in a cluster for minimizing the number of decoders needed for a certain bitstream. Also, the present invention relates to an electronic communication apparatus comprising a number of decoders, which is adapted to the method of the

15   invention.

Description of the Prior Art

An electronic communication apparatus as set out above can for instance be a mobile or cellular telephone

20   i.e. for UMTS ("Universal Mobile Telecommunication System"), a communicator, an electronic organizer, or a smartphone.

In the evolution of WCDMA ("Wide-band Call Division Multiple Access") a new concept called High Speed Downlink

25   Packet Access (HSDPA) has been proposed, which features a High Speed Downlink Shared Channel (HS-DSCH). One main feature of HSDPA is the introduction of an ARQ-protocol on the physical layer (Layer 1, L1), i.e below the Radio Link Control (RLC) protocol, may apply an ARQ-protocol for error

30   correction.

The ARQ-protocol in HSDPA is introduced at L1 to avoid RLC retransmissions introducing considerable Round Trip Time (RTT). In addition to being large, the RLC-induced RTT varies in length. The result is that higher-

35   layer protocols, in particular TCP, degrades the end-to-end

throughput of the transmission link as a result of the large and varying RTT.

The new ARQ-protocol introduced on L1 is intended to correct the majority of the channel errors before they
5   trigger RLC-retransmissions. The end-to-end throughput is then preserved since TCP experiences a less varying, and shorter, RTT. However, it is a prerequisite that the RTT of HS-DSCH on L1 is as small as possible. One large contributor to the RTT is the iterative decoding process in
10   the electronic communication apparatus. Consequently, it is preferred that the decoding process is as fast as possible.

The HSDPA mode features downlink bitrates up to 15 Mbps conveyed by turbo-coded data packets. This implies that more than one decoder may have to be employed in the
15   electronic communication apparatus for decoding the high bitrate. However, an iterative decoder implementation is quite large and expensive. Every additional decoder adds complexity to the communication apparatus and demands a lot of chip area.

20   To be able to fully handle the bitrates of HSDPA, up to 10 decoders are needed if a conventional decoding technique is used. As the iterative decoding process of the mobile telephone can be a large contributor to the RTT, each additional decoder may significantly increase the RTT
25   of the decoding process. Also, each additional decoder will increase the cost and the power consumption of the communication apparatus.

Summary of the Invention
30   It is an object of the present invention to provide a method for implementing a decoder process being capable of decoding an incoming stream of coded data blocks received with a high bitrate. More specifically, it is an object of the method according to the invention to minimize the
35   number of decoders required for receiving the high bitrate

of data blocks and optimizing the utilization of the decoders.

Further, it is an object of the method according to invention to reduce the complexity, power consumption, and
5   cost of the decoder implementation of an electronic portable communication apparatus.

Another object of the invention is to provide an portable electronic communication apparatus adapted for decoding an incoming stream of data blocks, which are
10   received with a high bitrate. Also, it is an object of the invention to provide an apparatus having low decoder complexity, low power consumption, and low cost, and which utilizes the decoders efficiently.

The above objects have been achieved by a method,
15   according to which it is possible to store an incoming data block in a queue, if all decoders of a cluster of iterative decoders are unavailable. The first decoder being available takes on the first data block in the queue. Further, the data block is transmitted according to a HARQ-protocol,
20   which provides the possibility to store unsuccessfully decoded data blocks. Therefore, an unsuccessfully decoded data block is moved to the end of the queue and combined with a retransmitted block of data before processed in any of the decoders of the cluster once again. The storing,
25   combining, and decoding process proceeds until an ACK-report can be communicated to a transmitter of the coded data block.

By scheduling the received blocks according to the method of the invention it is possible to minimize the
30   number of decoders required for a certain received bitrate. Specifically, according to the inventive method the high-speed bitrate associated with HSDPA can be received and decoded with fewer decoders, preferably two or three, than would be the case if the decoder-count was dimensioned for
35   the worst case. The worst case is when all received blocks

are iterated in the decoder a maximum number of iterations
even if a CRC (cyclic redundancy check) checks after a few
iterations. According to the invention, CRC is checked
after each decoder iteration and further iterations are

5   canceled as soon as the CRC checks. In this way, the
decoder utilization is enhanced compared to if the maximum
number of iterations is done. Consequently, the number of
decoders that needs to be deployed for a certain bitrate
can be minimized.

10   The above objects are also achieved by an electronic
communication apparatus capable of decoding data blocks
received over a wireless link in a communication network.
The inventive apparatus comprises a queue, which is adapted
for temporarily storing the data blocks, and a cluster of

15 decoders, which is adapted to decode the data blocks when
any of the decoders of the cluster is available. Advantages
of the apparatus according to the invention are low
complexity, low cost, and low power consumption.

          Further preferred features of the invention are

20 defined in the dependent claims.

          It should be emphasized that the terms
"comprises/comprising" when used in this specification is
taken to specify the presence of stated features, integers,
steps or components but does not preclude the presence or

25 addition of one or more other features, integers, steps,
components or groups thereof.

          Brief Description of the Drawings

          A preferred embodiment of the present invention will

30 now be described in more detail with reference to the
accompanying drawings, in which:

          FIG 1 shows a mobile telephone according to the
present invention operatively connected to a communication
network;

FIG 2 is a schematic diagram of a structure of a
stack of protocols in the mobile telephone and the
communication network, respectively;

FIG 3 is a block diagram of a queue and a cluster of
5   decoders arranged according to the invention;

FIG 4 illustrates three different coded data blocks;

FIG 5 is a flowchart of the scheduling of the
decoding process according to the present invention; and

FIG 6 is an exemplifying timing diagram of the
10   decoding process according to the invention.

Detailed Description of Embodiments

FIG 1 is intended to illustrate a portable
communication apparatus embodied as a mobile telephone 1,
15   in which the present invention is incorporated. The mobile
telephone 1 comprises an antenna 10, which in a
conventional way is used for connecting the mobile
telephone 1 to a communication network 21, over a wireless
link 21, through a base station 22. In a well-known way,
20   the communication network 21, for instance a UMTS network,
offers voice, data and fax call services to the user of the
mobile telephone 1. Also, the mobile telephone 1 may have
access to additional applications such as
internet/intranet, videoconference, news push, networked
25   games and video telephone through the communication network
21. Furthermore, the mobile telephone 1 is adapted to
receive (e.g. from a transmitter of the base station 22)
and decode an incoming stream of data block having a
bitrate of up to 15 Mbps. According to the method of the
30   invention, the received data blocks are put in a queue and
then scheduled on a pool of decoders, as will be described
in the following.

Further, the mobile telephone 1 comprises a display
11, a loudspeaker 12, a microphone 13 and a keypad 14, all

in a well-known way for creating an interface for using the
mobile telephone 1.

Further, the mobile telephone 1 comprises a receiver
and a transmitter for exchanging data with the
5   communication network 21 through the base station 22.

The mobile telephone 1 and the communication network
21 support High Speed Downlink Packet Access (HSDPA), which
features downlink bitrates up to 15 Mbps conveyed as turbo-
coded packets.

10   FIG 2 shows a simplified stack of protocols 31-35 for
WCDMA, which are arranged in the mobile telephone 1. As is
also shown in FIG 2, the communication network 20 comprises
in a similar fashion a stack of protocols 41-46
corresponding to the protocols 31-36 of the mobile
15   telephone 1. The protocols 31-36 and 41-46 facilitate the
exchange of data with the high bitrate between the mobile
telephone 1 and the communication network 21, as is well
known and will not be further discussed herein.

An RLC protocol 33, 43 provides, at least in
20   acknowledged mode, ARQ-functionality 50 between peers, that
is between the RLC layers 24, 44 of the mobile telephone 1
stack and the communication network 21 stack respectively,
as is indicated by a first two-way arrow in FIG 2.

Further, a second ARQ-protocol 51 is provided between
25   the physical layers (layer 1, L1) 36, 46 of the mobile
telephone 1 and the communication network respectively,
indicated by a second two-way arrow in FIG 2. More
specifically, the physical layer of the communication
network 21 is situated at the base station 22 in FIG 1. The
30   second ARQ-protocol 51 controls the transmission of data
between the base station 22 and the mobile telephone 1.
This second ARQ-protocol provides Hybrid ARQ (HARQ)
functionality. The HARQ-protocol 51 allows the mobile
telephone 1 a certain processing time, and the received
35   coded data blocks 61, 63 can therefore be stored in a queue

71 while they await decoding in any of the decoders in a
decoder pool 72. The data blocks 61, 63 represents various
types of coded data, e.g. voice, video and data, which will
be further disclosed in the following. Also, if the
5   decoding fails, the HARQ-protocol 51 requires a NACK (Not
ACKnowledged) report to be sent to a receiver in the base
station 22. The NACK information is then conveyed to a
HARQ-controller in the base station, which retransmits the
failed blocks 62. Meanwhile, the data block 61, 63 that was
10   unsuccessfully decoded can be stored in a memory of the
mobile phone 1 for subsequent combining with a
retransmitted data block 62 from the base station 22. This
will be discussed further below. By sending ACK/NACK
reports between the L1 36, 46 of the mobile phone 1 and the
15   base station 22, respectively, channel errors can be
corrected without involving the ARQ-protocol 50 of the RLC-
layer 34, 44. This stabilizes the RTT on the RLC-level.
        FIG 3 illustrates a decoder implementation according
to the present invention. A local memory, such as a RAM
20   memory or a flash memory, is provided in the mobile
telephone 1 for implementing a queue 71 for temporarily
storing the data blocks 61, 63 awaiting decoding, and
possibly combining with a retransmitted data block 62. The
queue 71 can be administrated and controlled by a central
25   processing unit 75 (CPU) implemented by any commercially
available microprocessor, or another type of programmable
logic circuitry. Therefore, the CPU 75 is connected to the
queue 75.
        The queue 71 is connected to a cluster 72 of decoders
30   having a number (N_{td}) of individual decoders, which are
arranged in a parallel configuration. By arranging the
decoders in parallel, each decoder can receive a complete
coded data block 61, 63 and process it independently of all
the other decoders of the cluster 72. In this embodiment,
35   preferably two or three turbo-decoders are utilized.

However, any number of iterative decoders, which can be
arranged in parallel, can be provided in the cluster 72 and
implemented according to the present invention. As a
consequence of the parallel arrangement of the decoders it
5   is possible to shut off some of the decoders when the bit
rate does not demand service from all decoders, and thus
power can be saved. This and the overall control of the
queue 71 and the decoder cluster 72 will be handled by the
CPU 75. Consequently, the CPU 75 is also connected to the
10 decoder cluster 72.

        Further, two feedback-loops 73, 74 provide the
possibility to move the first data block 61, 63 of the
queue 71 or a data block 61, 63 in the cluster 72 of
decoders, respectively, to the queue 71 if either the HARQ
15 protocol demands an ACK/NACK-report and the block 61, 63
has not been tried on the decoder, or if the block 61, 63,
is in the process of decoding but it has not passed CRC
(cyclic redundancy check) yet.

        In the UMTS-standard the encoder architecture type
20 used is referred to as Parallel Concatenated Convolutional
Code. In the UMTS-specification the encoder comprises two
8-state constituent encoders and one interleaver. Data
coded according to this standard can be decoded using an
iterative decoding technique, such as a turbo decoder
25 implementation. The service time in an iterative decoder is
random, which makes it advantageous to cluster a set of
decoders.

        FIG 4 illustrates the coded data block 61, relating
to a bit stream representing data such as voice, video, fax
30 etc., which is input to a transmitter. The data block 61
will be decoded by any of the decoders of the cluster 72.
Also, a retransmitted coded data block 62, and a combined
coded data block 63, which is also to be decoded by any of
the decoders of the cluster 72, is illustrated. The lines
35 of the blocks 61, 62, 63 correspond to coded bits of said

blocks. However, it should be noted that there usually are much more bits in a coded block than indicated in FIG 4, as the blocks of FIG 4 merely are illustrative. The retransmitted data block 62 relates to the same information
5   bits as the first data block 61. The combined data block 63 comprises the bits of the first and retransmitted data blocks 61, 62. The first data block 61 comprises certain coded bits, indicated by lines in the first data block 61 in FIG 3. Also, the retransmitted data block 62, which
10   relates to the same information bits as the first data block 61, may comprise other coded bits that are indicated by lines in the second data block 62 in FIG 4.

The retransmitted data block 62 is combined with the stored first data block 61 upon reception by, e.g., summing
15   the loglikelihood ratios of the received coded bits. As is understood, there may be more than one retransmission where each retransmitted block may necessarily not comprise the same coded bits. The combination forms the combined data block 63, which may contain more coded bits than data
20   blocks 61 and 62, respectively. However, some coded bits may overlap between block 61 and 62, which is indicated by lines in the third data block of FIG 3. When the combined data block 63 is formed, it replaces the first data block 61 in the queue 71. Thereafter it is ready for decoding in
25   any of the decoders of the cluster 72. A combined data block 63 being unsuccessfully decoded can once again be combined with a retransmitted data block for subsequent decoding.

The combination of data blocks 61, 62, 63 has the
30   advantage that the probability of correct decoding increases in many cases, depending on the radio channel conditions, with every retransmission and combination.

The data block 61, 63 currently undergoing the decoding process can be checked after each iteration for
35   errors by e.g. a CRC (Cyclic Redundancy Check) sequence.

According to the invention, CRC is checked after each
decoder iteration and further iterations are canceled as
soon as the CRC checks. The probability that the data block
is error-free increases fast with the number of iterations.
5   However, it should be noted that if the decoding of the
data blocks 61, 63 is not successfully completed after
about 3 iterations it is unlikely that the decoding will
succeed without a retransmission. As a consequence of this,
the iterative decoding process of the present invention can
10 be aborted prematurely at any stage of the decoding.
Instead, the processed data block 61, 63 can be stored in
the queue 72 and a retransmission of the data block 61, 63
is requested by the mobile telephone 1 by transmitting a
NACK-message to the base station 22.
15   If the maximum number of iterations is reached, the
iterative process of the decoder is unconditionally aborted
and the data block 61, 63 presently undergoing decoding is
moved to the back of the queue 72 and a retransmission of
the data block 61, 63 is requested. The retransmitted data
20 block can then be combined with the locally stored data
block 61, 63, as set out above, before decoding of the
combined block 63 commences, which increases the
probability for correct decoding.
        A method for scheduling the decoders of a mobile
25 telephone 1 according to the invention will now be
explained in detail.
        The scheduling method according to the invention
combine the possibility to retransmit data blocks 62 and
the possibility to abort the iterative decoding process of
30 a data block 61,63 undergoing processing. Also, it is
possible to shut off some of the decoders of the cluster 72
as discussed above. This will make use of the iterative
decoder resources of the mobile telephone 1 as efficiently
as possible. FIG 3 shows a schematic block diagram of the
35 queue 71 and the cluster 72 of decoders. A number of turbo

decoder are utilized in this embodiment, preferably two or three decoders, for the 15 Mbs bitrate data stream. The HARQ-protocol 51 on L1 46 of the transmitter of the base station 22 requires the decoding to be finished within a predetermined time-period, after which said transmitter requires an ACK/NACK-report of the decoding process from the receiver of the mobile telephone 1.

Reference is now made to FIG 5, illustrating in a block diagram the possible scheduling and processing of the data blocks 61, 63 awaiting decoding. First, the data block 61 is received at 100 by the receiver of the mobile telephone 1 and stored in the queue 1. Depending on the queuing time it is decided at 102 whether a retransmission is necessary. If so, a retransmission occurs, and the retransmitted block 62 and the queued block 61 are then combined at 102 to a combined block 63 and further processed at 103. If retransmission is not necessary, the coded data block 61 is transferred directly to 103, where it is determined whether any decoder is available. If so, the block 61, 63 is moved to any of the decoders being available for decoding at 104. Otherwise, the data block 61 is moved to the queue at 105.

If the block 61 is stored at 105, it is determined at 106 whether the time limit is reached before the data block 61, 63 is moved to any of the decoders. The outcome of this determination results in four different cases:

In the first case, if the time limit is reached before any decoder is available, the data block 61, 63 is moved to the end of the queue 72, as is also indicated by the first feedback-loop 73 of FIG 3. Also, an NACK-report is sent at 107 to the transmitter of the base station 22, which triggers a transmission of the retransmitted data block 62.

In the second case, if the time limit is not reached, the data block 61 is moved to any of the decoders of the

cluster 72 for decoding at 104. Then, it is determined
whether the decoding is successful within the time limit at
108. A successful decoding will trigger an ACK-report at
109 to be transmitted from the mobile telephone 1 to the
5   transmitter of the base station 22.

In a third case, if it is determined at 108 that the
decoding at 104 is not finished (i.e. unsuccessful
decoding) within the time limit, a NACK-report is
transmitted at 107 to the transmitter of the base station
10   22. Also, the data block 61 is moved to the end of the
queue 71, which is indicated with the second feedback loop
74 in FIG 3.

In the fourth case, if it is determined at 108 that
the data block 61 is unsuccessfully decoded, or the maximum
15   number of iterations is reached, within the time limit, and
a NACK-report is transmitted at 107 from the mobile
telephone 1 to the transmitter of the base station 22.
Also, the data block 61 is moved to the end of the queue
71, as is indicated with the second feedback loop 74 in FIG
20   3.

It should also be noted that it is possible to abort
the decoding process at 104 prematurely, such as after 2-3
iterations as discussed above, in case the CRC checks.

If a data block 61 is moved to the end of, and stored
25   in, the queue 71, the combination with the retransmitted
block 62 to a combined block 63 occurs during the queuing.
Then the combined block 63 is processed according to the
steps 106, 107, 104, 108 until the decoding is successfully
completed and the ACK report is transmitted at step 108.
30   In case a failed decoding is likely then it may be
preferred to interrupt the iterative process in the
decoder, and instead request a retransmission. After a fast
retransmission from the base station 22 the retransmitted
data block 62 can be combined with the data block 61 stored
35   in the queue 71 and the combined data block 63 can be

decoded instead. In most cases the performance with a quite small number of iterations, preferably 1-3, is satisfactory, and the scheduling method according to the invention exploit this possibility by automatically

5   adapting, i.e. increasing or decreasing, the maximum number of iterations (N_{iter}) in the decoders depending on the bitrate received. Therefore, the scheduling of the decoding process according to the invention provides the possibility to support high bit rates with a limited number of

10   decoders.

If the decoding of the data blocks 61, 63 are unsuccessful, or the data blocks 61, 63 is not moved to any of the decoders within the time limit, the data blocks 61, 63 will be moved to the back of the queue 71 as set out

15   above. When the transmitter of the base station 22 receives the ACK/NACK-report it determines weather to retransmit a specific data block 61, 63 (NACK) or transmit a new block (ACK). If a NACK-report is received a data block 62 will be prepared and transmitted to the mobile telephone 1. When

20   the retransmitted data block 62 is received by the mobile telephone 1, the retransmitted data block 62 is combined with the stored data block 61, 63 to a combined data block as set forth above. This combined data block 63 has an improved probability of being successfully decoded, as the

25   combined block 63 comprises more energy and/or parity bits. A data block 61, 63 can be combined several times, whereby the probability for successful decoding increases after each combination.

An important feature of the present invention is if

30   many data blocks 61, 63 fail to reach the cluster 72 of decoders before they are moved to the back of the queue 71. In such a case, the maximum number of allowed iterations N_{iter} of the decoders could be decreased automatically, e.g. by the CPU 75. In this embodiment, the adaptation of the

35   maximum number of iterations in each decoder is changed

automatically by the CPU 75 when the number of blocks 61, 63 being moved from directly from the beginning of the queue 71 to the end of said queue 71 reaches predefined indices. However, as is realized by the man skilled in the
5   art the adaptation is not necessary at all or can be implemented differently. This results in decreased probability of correctly decoded data blocks 61, 63, but it also decreases the decoding time, i.e. more data blocks 61, 63 can be tried on the cluster 72 of decoders per time
10 unit. The optimum number of iterations N_{iter}^{opt} in each decoder of the cluster 72, and the indices, is a design parameter, which can be set differently depending on the current link 20 quality as well as on the mobile telecommunication network 21 operator's preferences.
15   The maximum number of iterations of a certain decoder of the cluster of decoders 72 may also be automatically adapted in dependence on the type of coded data block that is received by said decoder for decoding. If the received data block is to be decoded for the first time, i.e. it is
20 not a combined data block, the maximum number may be set to a first number of iterations, such as eight. However, if the received data block is a combined data block 63, the maximum number of iterations may be set to a second number of iterations, such as 1-4. A combined data block has
25 increased probability of successful decoding. Thus, if the combined data block is not successfully decoded after the second number of iterations, it will probably not be decoded successfully. The first and second maximum number of iterations has the advantage that the throughput of the
30 cluster of decoders will increase.
         FIG 6 shows a simulation of a decoding operation when a N-staggerd Stop and Wait protocol with N=6 different lines is used for simulating the HARQ-protocol 51 on L1 36, 46. The scheduling scheme for the decoding process
35 according to the invention is utilized with one decoder.

The offered bitrate is 2.88 Mbps and the code rate is R=0.5
in an AWGN ("Additive White Gaussian Noise") channel. For
simplicity, only one decoder is used. However, as discussed
previously in this document it may be necessary to provide
5   more than 1 decoder to support a bitrate of up to 15 Mbps.

     In FIG 6 the decoding time, which includes a number
of iterations, is outlined by a line starting with a
circle. The time limit when it is necessary to send the
ACK/NACK-report to the transmitter is marked by a rhomb. A
10   successful decoding is marked by a circle after the line,
while an unsuccessful decoding is marked by a square.

     When the receiver of the mobile phone 1 receives the
data blocks 61, they are stored in the queue 71 if no
decoder is available. As can be seen in FIG 6, the first
15   arriving data block 61 can be directly moved to the
decoders without intermediate storing in the queue 71. The
storing is symbolized by a gap between the starting circle
and the completed reception of the data block 61, 63.
However, at the time data blocks number 2-6 are received,
20   the decoder is not available and consequently the data
blocks 61 have to be stored in the queue 71. The data
blocks 61 are then fed to the decoder according to an
"oldest-first" rule.

     The decoding of the first data block 61 is finished
25   within the time limit but is unsuccessful. Consequently, a
NACK-report is transmitted to the transmitter of the base
station 22, and the data block 61 is moved to the end of
the queue 71. Said transmitter receives the NACK-report and
prepares and retransmits the first data block as a
30   retransmitted data block 62. This corresponds to the fourth
case of FIG 5.

     The decoding of the third data block 62 is not
finished within the time limit, and a NACK-report is sent
to the transmitter. This corresponds to the third case of
35   FIG 5.

The first case of FIG 5, i.e. the data block 61 is
not moved to the decoder within the time limit, occurs the
first time the sixth data block of FIG 6 is to be decoded.
As FIG 6 discloses the operation of the decoder, the sixth
data block 61 is not present in FIG 6 during the first
round of its intended decoding. However, a NACK-report is
transmitted to the transmitter of the base station 22,
which triggers a retransmission. Therefore, the first time
the sixth data block appears it is a combined data block
63.

Finally, the second case of FIG 5, i.e. the decoding
is successful within the time limit, occurs when the second
data block has been combined with a retransmitted data
block 62, and the combined data block 63 is decoded for the
first time. Consequently, an ACK-report is transmitted to
the transmitter of the base station 22, which then can
transmit a seventh data block 61 over line two.

In the embodiment for the simulation result of FIG 6,
the "oldest first" rule is used, i.e. priority is given to
the data block 61, 63 in the queue having the longest
waiting time. This result in that the sixth data block in
FIG 6 is skipped in the first round, as discussed above.
However, in another embodiment it is equally well possible
to move the data blocks 61, 63 from the queue to the
decoders according to any other principle, e.g. Last in
First Out (LIFO), as long as the data block 61, 63 has been
combined with a retransmitted data block 62.

From FIG 6 it is evident that the scheduling method
according to the invention optimizes the usage of the
decoders, i.e a decoder is never idle as long as there are
more data blocks 61, 63 in the queue 71 waiting for
decoding. However, if some decoders become idle, or when
the number of blocks 61, 63 in the queue 71 is low, it is
possible to automatically shut off any of the decoders in
order to save power. Consequently, if the number of blocks

in the queue 71 becomes too large, a non-active decoder can be activated automatically. In this embodiment, a controller, such as CPU 75, automatically handles the activation of the decoders. For example, any of the

5   decoders can be activated/deactivated when the received bitrate reaches a certain predefined level. The level is a design parameter, which is based on e.g. in operator preferences in each particular case. However, as is realized by the man skilled in the art this

10 activation/deactivation is not necessary or can be implemented differently. In the embodiment shown $N_{iter}=15$ was chosen as an example, and as a result some data blocks will expire and be transmitted to the back of the queue 71 before they reach the decoder. However, any other

15 reasonable number of iterations in the decoders is equally well possible within the scope of the invention.

    As is understood, the overall operation of the mobile telephone and the exchanging of data blocks 61, 62 are well known in the art and therefore will not be further

20 discussed in this document. The operation of the queue 71 and the cluster of the decoders, such as queue handling and adaptation of the number active decoders and their respective maximum number of iterations in the decoders can be provided by the same CPU 75, which can be any

25 commercially available microprocessor or programmable logic circuitry.

    The invention has been described above with reference to some embodiments. However, other embodiments than the ones referred to above are equally well possible within the

30 scope of the invention, which is best defined by the appended independent claims.